Vegetation – Seedling Trees

This document describes methods for monitoring changes in density of seedling trees in forest or woodland areas. The sampling unit is a permanently marked plot of adjustable size and shape where individual seedling trees are tallied by species and height class. These methods were developed for the National Park Service's (NPS) fire monitoring program but may be adapted for other monitoring purposes. For background information on the fire monitoring program, including the purpose and overview of the program, related policy, and personnel responsibilities, refer to Chapter 1, pages 1-5 of the NPS Fire Monitoring Handbook (FMH, http://www.nps.gov/fire/fmh/FEMHandbook.pdf). An overview of management objectives and the process for developing corresponding monitoring program objectives is reviewed in Chapter 3, pages 19-32 of the FMH.

Sampling design, including defining the population of interest, pilot sampling, calculating minimum sample size, and addressing potential design problems, is described in FMH Chapter 4, pages 33-54. Methods for generating and selecting plot locations and installing plots are found in FMH Chapter 5, pages 59-79. The schedule for monitoring prior to and following fire treatment is located in FMH Chapter 5, pages 55-58, although the schedule may be revised for other purposes. For a list of field equipment needs recommended for implementing this protocol, see FMH Appendix E, pages 221-224. Information about monitoring program file maintenance and data storage is found in FMH Chapter 5, pages 112-113. To review data quality procedures, see FMH Chapter 5, pages 114-117.

The field methods for the protocol described below are taken from FMH Chapter 5, page 102 (http://www.nps.gov/fire/fmh/FEMHandbook.pdf). Specific forms developed for field data collection follow the protocol description.

Monitoring Seedling Trees

Seedling trees are defined in this monitoring system as living trees with a diameter at breast height (DBH) <2.5 cm (**recording information on dead seedlings is optional**). Trees that are less than the height required for DBH are treated as seedlings, regardless of age and diameter. By definition, a tree cannot be pole-size **and** less than the height necessary for DBH. You may modify this definition for your purposes; see page 44 for details. **Note:** Accuracy standards for each seedling tree variable are listed in Table 24.

Table 24. Accuracy standards for seedling tree (RS) variables.

Seedling Tree		
DBH	<2.5 cm	No Errors
Seedling Height		Within Class
# of Individuals		± 5%

COUNT SEEDLING TREES TO OBTAIN SPECIES DENSITY

Count the number of seedling trees by species within the sampling area chosen during the monitoring design process (see page 45). Check your protocols (FMH-4) before proceeding.

RS Procedures

Record the heading information on the Seedling tree data sheet (FMH-10 in Appendix A). For all seedling trees, record the number of individuals (Num) by species (Spp) on the FMH-10. An optional sketch map of the seedling tree aggregates may be made on any tree map (FMH-11, -12, -13, or -14). In areas with few seedlings in the understory or where tracking individual seedlings through time is important, an optional mapping procedure is to give individual seedlings sequential map numbers (Map#), so that data can be correlated between the Seedling tree data sheet (FMH-10) and the appropriate tree map (FMH-11, -12, -13, or -14). On the data sheet, indicate whether each group of tallied trees is alive or dead (Live) or a resprout (Rsprt).

Seedling Resprout Class

Seedlings can now be classed as **resprouts**. See page 255 in the Glossary for a definition.

Anticipated dramatic increases in postburn seedling density

The seed banks of some tree species may germinate profusely following a burn. Rather than count thousands of seedlings, it may be more efficient to subsample the plot during temporary high density periods. To subsample, grid the sample area listed on your FMH-4 and randomly select an appropriate subsample (i.e., 10%, 20%) of the area. Then proceed to count the individuals in the subsample area and extrapolate to the full sample area listed on your FMH-4. Again, this should only be done in consultation with resource and fire managers.

OPTIONAL MONITORING PROCEDURES

Measure Seedling Tree Height

Record the number of seedling trees (Num) by species (Spp) in each height class (Hgt) on the Seedling tree data sheet (FMH-10) for each tree encountered. Use the following height class codes (Table 25, also available for reference on FMH-10):

Table 25. Height class codes for seedling trees.

Code	Height (cm)	Code	Height (cm)	Code	Height (cm)	Code	Height (cm)
1	0–15	5	100.1–200	9	500.1–600	13	900.1+
2	15.1–30	6	200.1–300	10	600.1–700		
3	30.1–60	7	300.1–400	11	700.1–800		
4	60.1–100	8	400.1–500	12	800.1–900		

Note: Measure height from ground level to the highest point of growth on the tree. The highest point on a bent tree would be down the trunk of the tree instead of at the growing apex.

Park/Unit 4-Character Alpha Code: ________

FMH-10 **SEEDLING TREE DATA SHEET** Page __ of __

Plot ID: ____________________ B / C (Circle One) Date: ___/___/___

Burn Unit: ____________________ Recorders: ____________________

Burn Status:Circle one and indicate number of times treated, e.g., 01-yr01, 02-yr01

00-PRE ____ Post ____-yr01 ___-yr02 ___-yr05 ___-yr10 ___-yr20Other: ___-yr____; ____-mo___

Record: map number (Map#, Optional), species code (Spp), live/dead, height by class (Hgt Code, Optional), resprout (Rsprt), and # by species and height class (Num/Tally).

Area Sampled: ______________in Quarter(s): ____________

Map#	Spp	Live	Hgt Code	Rsprt	Num/Tally	Map#	Spp	Live	Hgt Code	Rsprt	Num/Tally
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	
		Y N		Y N				Y N		Y N	

Height Class Codes (height in centimeters)

1	0–15	**5**	100.1–200	**9**	500.1–600	**13**	900.1+
2	15.1–30	**6**	200.1–300	**10**	600.1–700		
3	30.1–60	**7**	300.1–400	**11**	700.1–800		
4	60.1–100	**8**	400.1–500	**12**	800.1–900		

Note: Measure height from ground level to the highest point of growth on the tree. The highest point on a bent tree would be down the trunk of the tree instead of at the growing apex.

Date Entered: ___/___/___

Park/Unit 4-Character Alpha Code: ________

FMH-10A **ALTERNATE SEEDLING TREE DATA SHEET** Page __ of __

Plot ID: ____________________ B / C (Circle One) Date: ___/___/___

Burn Unit: ____________________ Recorders: ____________________

Burn Status:Circle one and indicate number of times treated, e.g., 01-yr01, 02-yr01

00-PRE ___ Post ___-yr01 ___-yr02 ___-yr05 ___-yr10 ___-yr20Other: ___-yr___; ___-mo___

Record: map number (Map#, Optional), species code (Spp), live/dead, height by class (Hgt, Optional), resprout (Rsprt), and # by species and height class (Num/Tally).

Area Sampled: ______________in Quarter(s): ____________

Map#	Spp	Live	Hgt Code	Rsprt	Num	Tally
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		
		Y N		Y N		

Height Class Codes (height in centimeters)

1	0–15	**5**	100.1–200	**9**	500.1–600	**13**	900.1+
2	15.1–30	**6**	200.1–300	**10**	600.1–700		
3	30.1–60	**7**	300.1–400	**11**	700.1–800		
4	60.1–100	**8**	400.1–500	**12**	800.1–900		

Note: Measure height from ground level to the highest point of growth on the tree. The highest point on a bent tree would be down the trunk of the tree instead of at the growing apex.

Date Entered: ___/___/___

Park/Unit 4-Character Alpha Code: _____

FMH-4 **MONITORING TYPE DESCRIPTION SHEET**

Monitoring Type Code: _____ Date Described: __/__/__

Monitoring Type Name: _____

FGDC Association(s): _____

Preparer(s) (FEMO/RMS/FMO): _____

Burn Prescription (including other treatments: _____

Management Objective(s): _____

Monitoring Objective(s):_____

Objective Variable(s): _____

Physical Description: _____

Biological Description:_____

Rejection Criteria:_____

Notes:_____

Date Entered: ____/____/____

PLOT PROTOCOLS

GENERAL PROTOCOLS		(Circle One)			(Circle One)	
Preburn	Control Treatment Plots (Opt)	Y	N	Herb Height (Opt)	Y	N
	Herbaceous Density (Opt)	Y	N	Abbreviated Tags (Opt)	Y	N
	OP/Origin Buried (Opt)	Y	N	Herb. Fuel Load (Opt)	Y	N
	Voucher Specimens (Opt)	Y	N	Brush Fuel Load (Opt)	Y	N
	Count Dead Branches of Living Plants as Dead (Opt)				Y	N
	Width Sample Area Species Not Intercepted But Seen in Vicinity of Herbaceous Transect(s):					
	Length/Width Sample Area for Shrubs:			Stakes Installed:		
	Herbaceous Frame Dimensions:					
	Herbaceous Density Data Collected At:					
Burn	Duff Moisture (Opt)	Y	N	Flame Depth (Opt)	Y	N
Postburn	100 Pt. Burn Severity (Opt)	Y	N	Herb. Fuel Load (Opt)	Y	N
	Herbaceous/Shrub Data (Opt): FMH- 15/16/17/18					

FOREST PLOT PROTOCOLS		(Circle One)			(Circle One)	
Overstory (>15 cm)	Live Tree Damage (Opt)	Y	N	Live Crown Position (Opt)	Y	N
	Dead Tree Damage (Opt)	Y	N	Dead Crown Position (Opt)	Y	N
	Record DBH Year-1 (Opt)	Y	N			
	Length/Width of Sample Area:			Quarters Sampled: Subset • Q1 • Q2 • Q3 • Q4		
Pole-size (≥2.5≤15)	Height (Opt)	Y	N	Poles Tagged (Opt)	Y	N
	Record DBH Year-1 (Opt)	Y	N	Dead Pole Height (Opt)	Y	N
	Length/Width of Sample Area:			Quarters Sampled: Subset • Q1 • Q2 • Q3 • Q4		
Seedling (<2.5 cm)	Height (Opt)	Y	N	Seedlings Mapped (Opt)	Y	N
	Dead Seedlings (Opt)	Y	N	Dead Seedling Height (Opt)	Y	N
	Length/Width of Sample Area:			Quarters Sampled: Subset • Q1 • Q2 • Q3 • Q4		
Fuel Load	Sampling Plane Lengths:___ 1 hr • ___ 10 hr • ___ 100 hr • ___ 1,000 hr-s • ___ 1,000 hr-r					
Herbaceous	Cover Data Collected at: Q4–Q1 • Q3–Q2 • 0P–50P • Q4–30 m					
Postburn	Char Height (Opt)	Y	N	Poles in Assessment (Opt)	Y	N
	Collect Severity Along: Fuel Transects • Herbaceous Transects					

(Opt) = Optional

Park/Unit 4-Character Alpha Code: _____

FMH-5 **PLOT LOCATION DATA SHEET**

Plot ID: _____ B / C (Circle One) Date: ___/___/___

Burn Unit: _____ Recorder(s): _____

Topo Quad: _____ Transect Azimuth: ____ Declination: _____

UTM ZONE: _____	Lat: _____	Section: _____	Slope (%) along Transect Azimuth: _____
UTMN: _____	Long: _____	Township: _____	Slope (%) of Hillside: _____
UTME: _____		Range: _____	Aspect: _____ Elevation: _____

Location Information Determined by (Circle One): Map & Compass / GPS

If determined by GPS: Datum used: _____ (Circle One) PDOP/EHE: _____

Fire History of the Plot (including the date of the last known fire):_____

_____

1. Road and trail used to travel to the plot:_____

_____

_____

2. True compass bearing at point where road/trail is left to hike to plot: _____°

3. Describe the route to the plot; include or attach a hand-drawn map illustrating these directions, including the plot layout, plot reference stake and other significant features. In addition, attach a topo, orthophoto, and/or trail map.

4. Describe reference feature: _____

5. True compass bearing from plot reference feature to plot reference stake: _____°

6. Distance from reference feature to reference stake: _____m

7. Problems, comments, notes:_____

_____

_____

FMH-5A **HISTORY OF SITE VISITS**

Plot ID: ________________ B / C (Circle One) Burn Unit: ________________________

Date	Burn Status	Purpose	Comments

 Date Entered: ____/____/____

Park/Unit 4-Character Alpha Code: _____

FMH-6 **SPECIES CODE LIST** Page ___ of ___

Use this form to record unknowns and official species codes. **Tip:** Place an asterisk next to each species you voucher.

Species Code	Life Form	Genus/Species (spell out full name)	Native (Circle One)	Annual/ Biennial/ Perennial
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	

Life Forms Codes:

A	Fern or Fern Ally	**G**	Grass	**R**	Grass-like	**T**	Tree	*****	Substrate
F	Forb	**N**	Non-vascular	**S**	Shrub	**U**	Subshrub	**V**	Vine

Date Entered: ___/___/___

VOUCHER SPECIMEN DATA COLLECTION FORMS

Date: Plot ID: Collected by: Coll. #

Latin Name: Family:

Common Name:

Description: ann/bien/per Life form: ht.: Habitat:
flr. color: other:
fruit type:

Topo Quad: Assoc. spp.:

Location (UTM, lat/long): Elev.: Slope: Aspect:

Comments:

Date: Plot ID: Collected by: Coll. #

Latin Name: Family:

Common Name:

Description: ann/bien/per Life form: ht.: Habitat:
flr. color: other:
fruit type:

Topo Quad: Assoc. spp.:

Location (UTM, lat/long): Elev.: Slope: Aspect:

Comments:

Date: Plot ID: Collected by: Coll. #

Latin Name: Family:

Common Name:

Description: ann/bien/per Life form: ht.: Habitat:
flr. color: other:
fruit type:

Topo Quad: Assoc. spp.:

Location (UTM, lat/long): Elev.: Slope: Aspect:

Comments:

Date: Plot ID: Collected by: Coll. #

Latin Name: Family:

Common Name:

Description: ann/bien/per Life form: ht.: Habitat:
flr. color: other:
fruit type:

Topo Quad: Assoc. spp.:

Location (UTM, lat/long): Elev.: Slope: Aspect:

Comments:

Park/Unit 4-Character Alpha Code: _____

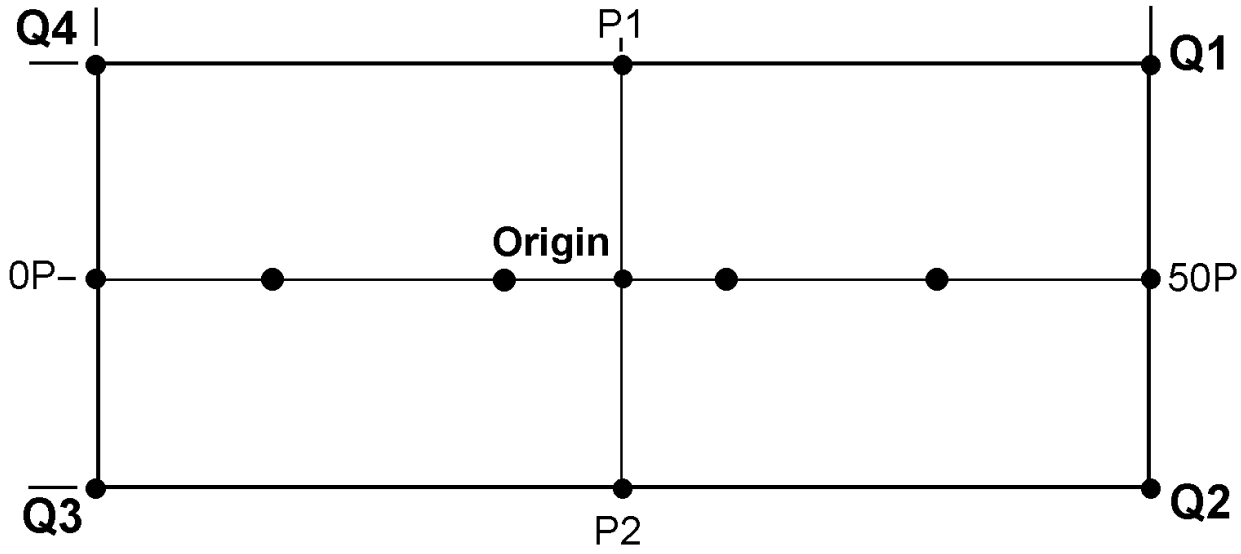
FMH-7 **FOREST PLOT DATA SHEET**

Plot ID: _____ B / C (Circle One) Date: ____/____/____

Burn Unit: _____ Recorders: _____

Burn Status:Circle one and indicate number of times treated, e.g., 01-yr01, 02-yr01

00-PRE ____ Post ____-yr01 ___-yr02 ___-yr05 ___-yr10 ___-yr20Other: ___-yr___; ____-mo___



Overstory: _____m^2 in Q ____ Pole: _____m^2 in Q _____ Seedling: _____m^2 in Q ____

Sampling Areas: Shrub: _____m^2 along Q4–Q1 • Q3–Q2 • 0P–50P • Q4–30 m

Shade in the sampling areas for each tree class and for the shrub sampling area(s) on the plot layout above.

Photo Subject Order		**Fuel Load Transects**		
			Azimuth	Slope
1. 0P → Origin	6. Q2 → Q3			
2. Q4 → Q1	7. P2 → Origin	1		
3. P1 → Origin	8. Q3 → Q2	2		
4. Q1 → Q4	9. Origin → REF	3		
5. 50P → Origin	10. REF → Origin	4		

Record photo documentation data for each visit on FMH-23, Photographic record sheet

Draw in fuel load transect lines on the plot layout above.

Date Entered: ____/____/____

Park/Unit 4-Character Alpha Code: _____

FMH-11 **FULL PLOT TREE MAP**

Plot ID: _____ B/C (Circle One) Date: ____/____/____

Burn Unit: _____ Recorders: _____

Burn Status:Circle one and indicate number of times treated, e.g., 01-yr01, 02-yr01

00-PRE ____ Post ____-yr01 ___-yr02 ___-yr05 ___-yr10 ___-yr20 Other: ___-yr____; ____-mo___

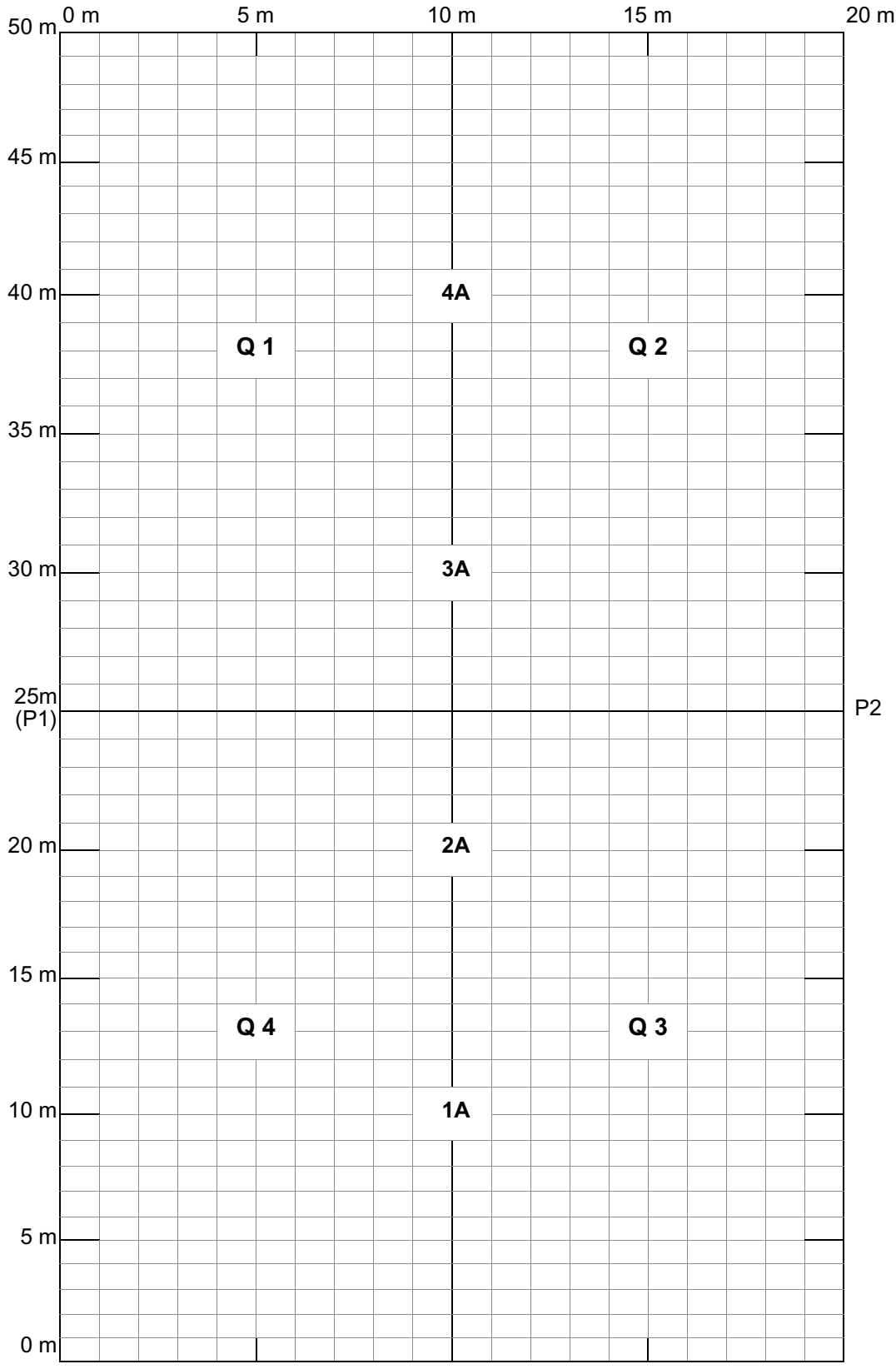
Tree Class

(Circle One)

Overstory

Pole

Seedling



Park/Unit 4-Character Alpha Code: _____

FMH-12 **QUARTER PLOT TREE MAP**

Plot ID: _____ B/C (Circle One) Date: ____/____/____

Burn Unit: _____ Recorders: _____

Burn Status:Circle one and indicate number of times treated, e.g., 01-yr01, 02-yr01

00-PRE ____ Post ____-yr01 ___-yr02 ___-yr05 ___-yr10 ___-yr20 Other: ___-yr____; ____-mo___

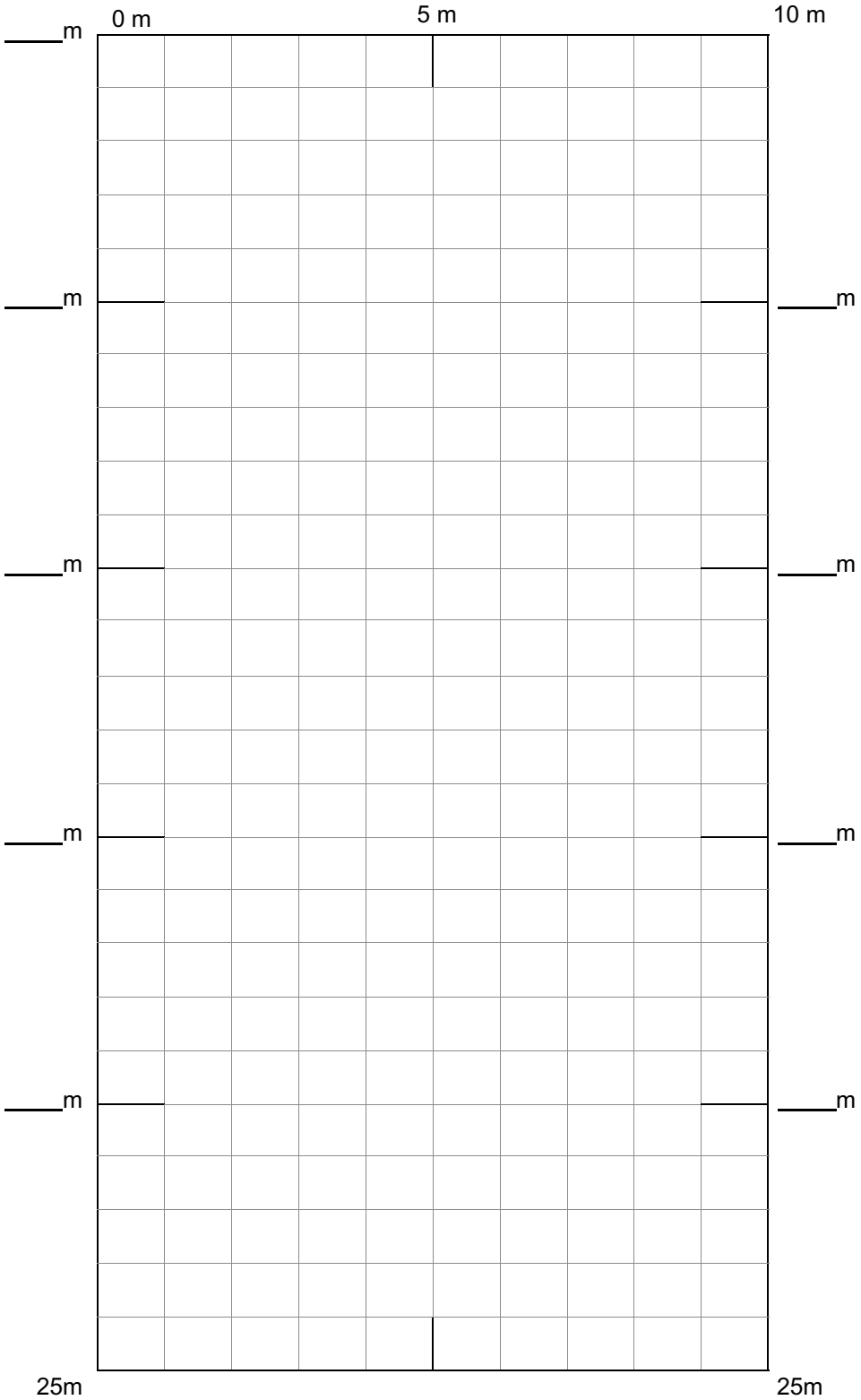
Tree Class

(Circle One)

Overstory

Pole

Seedling



Park/Unit 4-Character Alpha Code: _____

FMH-13 **ALTERNATE TREE MAP**

Plot ID: _____ B/C (Circle One) Date: ____/____/____

Burn Unit: _____ Recorders: _____

Burn Status:Circle one and indicate number of times treated, e.g., 01-yr01, 02-yr01

00-PRE ____ Post ____-yr01 ___-yr02 ___-yr05 ___-yr10 ___-yr20 Other: ___-yr____; ____-mo___

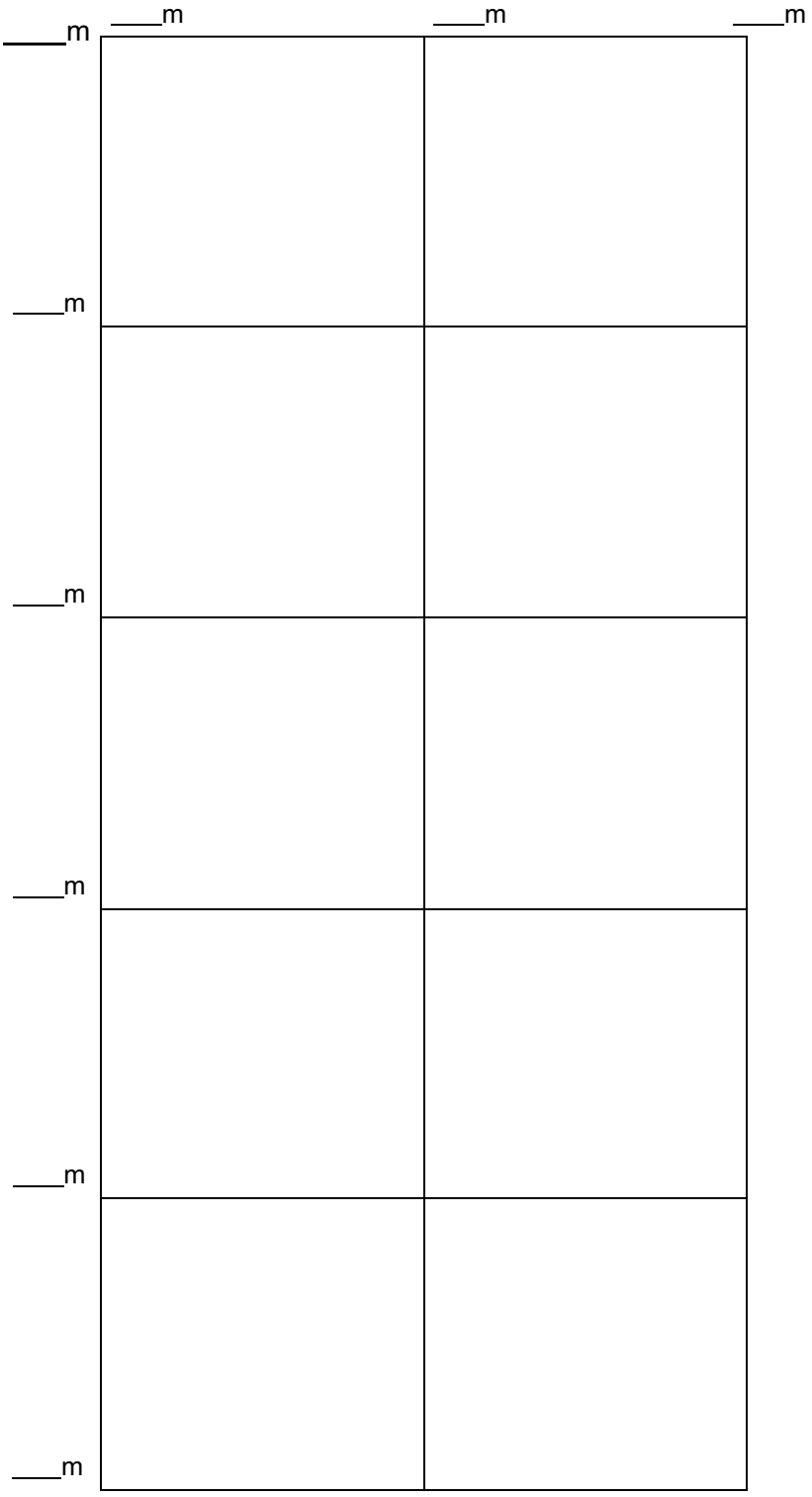
Tree Class

(Circle One)

Overstory

Pole

Seedling



Park/Unit 4-Character Alpha Code: _____

FMH-14

50 m^2 TREE MAP

Plot ID: _____ B/C (Circle One) Date: ____/____/____

Burn Unit: _____ Recorders: _____

Burn Status:Circle one and indicate number of times treated, e.g., 01-yr01, 02-yr01

00-PRE ____ Post ____-yr01 ___-yr02 ___-yr05 ___-yr10 ___-yr20 Other: ___-yr____; ____-mo___

Tree Class

(Circle One)

Overstory

Pole

Seedling